Information Paper
Benefits of Geospatial Data and Systems (GD&S)
To USACE Business Areas

I. Purpose: The purpose of this paper is to document the benefits of GD&S to Corps Business areas. Since GD&S cuts across many of the Corps functions, benefits are numerous, but have often been difficult to capture. We often focus on more glamorous aspects of implementing GD&S and do not document benefits or evaluate how GD&S have impacted the business process. Since there is not a corporate GD&S implementation plan, many folks end up justifying using GD&S on a case by case basis. In a sense, selling GD&S technology within each business area at each district.

The purpose of this paper is to prepare a living document of projects or cases where benefits have been identified and quantified. Cases can then be used to help others in identifying benefits of GD&S technology for justification activities, such as, cost/benefit analysis, management briefings, etc.

II. Definitions: Geospatial Data are collections of information referenced to locations on the Earth. Geospatial Data Systems (GDS) are automated systems that employs geospatial data including: Geographic Information Systems (GIS), Land Information Systems (LIS), Remote Sensing or Image Processing Systems, Computer-Aided Design and Drafting (CADD) systems, Automated Mapping/Facilities Management (AM/FM) systems, and other computer systems that employ or reference data using either absolute, relative, or assumed coordinates such as hydrographic surveying systems. The term Geospatial Data and Systems (GD&S) refers collectively to the data and systems.

Corps Civil Business Areas have been identified as:

1) Navigation: Provide safe, reliable, and efficient inland and coastal waterborne transportation systems (channels, harbors, and waterways) for movement of commerce, national security needs, and recreation.
2) Flood and Coastal Storm Damage Reduction: Save lives and reduce the level of property damage incurred by floods and storms using both traditional and non-traditional methods.
3) Hydropower: Provide reliable, efficient, and cost effective power and related services to power marketing agencies (PMAs) and the Federal Energy Regulatory Commission.
4) Regulatory: Balance the uses and protection of the nation's wetlands and water through the Army permitting process.
5) Environment: Ensure compliance, mitigate project degradation, and maintain or improve current environmental conditions.
6) Emergency Management: Prepare for and respond to natural and national emergencies under Department of Defense (DOD), FEMA, and other agency authorities.

7) Recreation: Provide public recreation opportunities and experiences compatible with other project purposes.
8) Water Supply: Provide and manage storage in Corps multiple purpose reservoirs in conjunction with other purposes for beneficial needs.
9) Support for Others: Assist other governmental and other entities to achieve their mission consistent with the capabilities and expertise of the Corps.

Corps Military Programs Business Areas have been identified as:

1) Construction ???
2) Facility Management???

III. Benefits of GIS to a project can be grouped into tangible or intangible benefits. Although difficult to capture, measures can be assigned to tangible benefits and they can be quantifiable. Intangible benefits can not be measured; however, intangible benefits should not be overlooked simply because they are difficult to measure and comprehend. "Intangible benefits may include improved decision making, improved public image, reduction in confusion caused by contradictory data, improved cooperation between users through data sharing, increased staff professionalism and morale, better ability to cope with unexpected events, new knowledge through improved data analysis and unanticipated applications.- Clarke" Quantifying intangible benefits can not be done without expensive surveys and analysis. Your results are often highly suspicious because of the uncertainty involved in assigning values to subjective information.

Some argue that instead of trying to quantify intangible benefits the best approach is to "provide a clear description and analysis of such benefits to enable judgement by senior decision makers. - Clarke". However, "when the business case reaches the executive office, the officer's eyes generally focus on the "bottom line", and glaze over when reading about the noneconomic factors. If a plan doesn't promise to return a significant profit within the next couple of years, it typically is not considered further. Knowing this, a planner preparing a business case typically place a heavy emphasis on the economics and perhaps toss in a paragraph explaining "unquantifiable" benefits.- Donaldson"

IV. Since the Corps places a heavy emphasis on the economics and quantifiable benefits, we will focus on the tangible benefits that result in implementing a GIS. Tangible benefits of GIS were identified by the USACE GD&S Field Advisory Group and categorized into three distinct areas. They are:

1. Increase Revenues felt by expanding customer base; reimbursable work brought to the Corps because of GIS
2. Savings
   a. Data Retention - increase life of data; instead of completely recollecting data, build on existing data

   b. Data Sharing - groups get together and collaborate on a data collection effort, decreases data duplication
   c. Increase efficiency - decrease effort to do a task; measured in time and FTE's
3. Better Product
   a. Increase Accuracy - compare to older methods
   b. Better decisions (more defendable) - was GIS used for decision making

Quantifiable benefits can be obtained through specific examples or case studies - Calkins, Clarke, Donaldson. Table 1 summarizes specific cases where GIS has resulted in increased revenue, monetary savings and/or better product/decision.

USACE Business Areas	***Increase Revenue***	***Savings*** *Data Retention*	*Data Sharing*	*Increase Efficiency*	***Better Product*** *More Accurate*	*Defendable Decisions*
Navigation • REEGIS (CEMVD)		✓		✓	✓	
Flood and Coastal Storm Damage Reduction • Coastal Feasibility Studies (CENAP) • Bore Hole Database (CENAP)		 ✓	✓	✓		
Hydropower						
Regulatory • Beaver Lake Shoreline Management (CESWL)		✓	✓	✓	✓	✓
Environment • REEGIS (CEMVD) • C&D Canal Deepening Study (CENAP) • Bore Hole Database (CENAP)		 ✓		✓ ✓	✓	✓
Emergency Operations • Hurricane Andrew (CREL) • Delaware Hazards Project (CENAP) • Caribbean Storm Surge Mapping (CESAJ)			 ✓	✓ ✓	✓ ✓	✓ ✓
Recreation • Beaver Lake Shoreline Management (CESWL) • Blue Marsh Lake (CENAP)		✓	✓	✓	✓	✓
Water Supply • Fort Dix Groundwater Study (CENAP)		✓			✓	
Facility Management (MP) • Edwards Air Force Base (CESWF)						
Support for Others • FEMA Flood Insurance Rate Map (CEMVP) • Assistance to States/Tribes; Section 22 (CELRE) • FEMA (CENAP)	✓ ✓ ✓					

Table 1: Benefits of GIS to Corps Business Areas

V. Summary

"It is important to recognize that no matter how rigorous and extensive the analysis, in the end the decision to acquire a GIS will be a judgement call. While that judgement can be substantially aided by cost-benefit analysis, there does not exist an objective, unbiased analysis procedure than can, by itself, provide the correct "go/no-go" decision. There are two principal reasons for this. First …uncertainty. Second, and perhaps more important is that the decision to provide geographic information is rarely justified on the grounds of costs and benefits in the first place- Clarke"

Next step, capturing benefit information to support implementing an enterprise GIS system

VI. References

GIS Specification, Evaluation, and Implementation, A L Clarke, 1991

Why Cash Flow Analysis Stifles Innovation and Unfairly Penalizes AM/FM/GIS, William Donaldson, 1994

Use and Value of Geographic Information, Calkins, 1989

VII. Participants

The USACE GD&S Field Advisory Group developed this paper. Contributing members include:

Ms Patricia Anslow, Little Rock District, Upper White River Project

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Appendix A: Specific cases supporting matrix

Contributor: Little Rock District, Water Resources and Environmental Branch
Project: Upper White River Project Office

Project Description: *Identify Business Area[s]* Beaver Lake is one of the lakes in the Upper White River Project Office, located in Northwest Arkansas. The Little Rock District lake has 483 miles of shoreline to management for natural resources. There is one manager and seven rangers to control 13 parks with more than 300 camp sites and amenities, over 1200 boat dock permits, 200 real estate permits, 12 marinas, and 3,500 acres of public property. The property is regulated for mowing, limited use permits, easements, flood control, natural resources, public use, endangered and rare species, and environmental regulations to include wetlands, cultural resources, and RCRA. The recreation facilities are visited by thousands of people every year.

In July 1996, the Project Office and District Natural Resources Branch decided to rewrite their Shoreline Management Plan that regulated all of these public natural resources. At that time, paper maps were used to keep up with all of the permits, land, and regulatory actions. A pilot project was conducted to determine what aspects of the data were best suited for a Geographic Information System (GIS) database. Then, a GIS database was completed for the entire lake in October 1997. The data layers included Corps of Engineer, county and park boundaries, survey monuments, shoreline zones, docks, cultural resources, real estate permits, soils, land use land cover (lulc), roads, streams, water bodies, public land survey system (PLSS), and the databases for each appropriate layer. The Beaver Lake Shoreline GIS development cost was $30,000.00.

Benefits of GIS to the Project:

Increase Revenue

Other project offices in the district have requested scope of work and cost estimate for similar GIS databases. There is potential to reproduce the database schema for state and city public resources through Planning Assistance to States (PAS) Program and bring in $100,000.00 of dollars to the District.

Savings

Data Retention. The existing paper maps were torn and in a state of disrepair. The data was altered through the stretch of paper over time. The paper permits took up a great deal of storage space. Now, all of the graphical and statistical data can fit on a single CD. This data will never be lost or altered due to storage conditions. Trend analysis will be much easier in the future as additions can be documented faster and more efficiently.

Data Sharing. The Shoreline GIS database is an excellent example of data sharing. This GIS database makes it much easier for sharing not only within the project office, but communication between the District Office and the project is increased enormously. The database is on the LAN at the project office. It is

transferred between the District and project office on Compact Disc (CD), file transfer protocal (ftp), and can even be emailed if the files are small. The graphical displays can be shared and manipulated simultaneously between Little Rock and Rogers office 209 miles away.

There has been a cost savings of $10,000.00 in the reduction of duplication during production of project maps.

Increase Efficiency. The GIS database reduces the following task effort, which equates to either dollars saved or dollars reallocated for other tasks.

TASKS	Hours/Item Saved	# of Items Annually	Total Hours	Rate	Annual Saving
1. Dock Permit Process	10.0	50	500	13	6500
2. Boundary Verification	10	100 miles	1000	13	13000
3. Management requests	2.0	100	200	13	2600
4. Maintain maps and database of permits	1.0	1500	1500	13	19500
5. Public data requests	.50	400	200	13	2600
6. Production of Segment Maps, Public Meeting Maps, Display Maps	16	40	640	22	14080
7. Enforcing Encroachments	8	25	200	13	2600
8. Permit verification with ground data (cultural resources ...)	8	50	400	13	5200
TOTAL					66080

Better Product

Increase Data Accuracy. The current GIS data for Beaver Lake Shoreline is more accurate than any previously existing maps. The old maps were pictorial representations. The GIS database is based on GPS survey points, and quad maps meeting the national map accuracy standard for 1:24,000 scale. Future Shoreline GIS database will be based off of digital orthophotography at 1:4800 scale. The rangers can analyze data with greater assurances, particularly in matters of property encroachments.

Defendable Decisions. An Environmental Assessment (EA) is currently underway for the proposed changes to the Shoreline Management Plan. The GIS database provides much of the necessary ground data collection efforts. Decisions are now based on a combination of GIS database and field surveys. The existence of the GIS saved $5,000.00 in the EA data collection process.